CLAIMS:

1. Method for assessing feeding and/or weight gain pattern in a subject comprising the measurement of a melanocortin peptide in a sample obtained from said subject and comparison of the measured value with a reference value.

2. Method for predicting risk of obesity in a subject comprising the measurement of a melanocortin peptide in a sample obtained from said subject and comparison of the measured value with a reference value

3. Method for diagnosing imbalance in energy homeostasis in a subject comprising the measurement of a melanocortin peptide in a sample obtained from said subject and comparison of the measured value with a reference value.

4. Method for diagnosing obesity in a subject comprising the measurement of a melanocortin peptide in a sample obtained from said subject and comparison of the measured value with a reference value

5. Method for screening medicaments for the adverse reactions of imbalance in energy homeostasis, feeding/weight gain patterns or obesity in a subject to whom the medicament has been administered comprising the measurement of a melanocortin peptide in a sample obtained from said subject, and comparison of the measured value with a reference value.

6. Method for screening foods and/or diets for the adverse reactions of imbalance in energy homeostasis, feeding/weight gain patterns or obesity in a subject to whom the medicament has been administered comprising the measurement of a melanocortin peptide in a sample obtained from said subject, and comparison of the measured value with a reference value.

7. A method according to any one of claims 1 to 6, wherein the melanocortin peptide measured is α-MSH or desacetyl-α-MSH.

8. Method for assessing feeding and/or weight gain pattern in a subject comprising the measurement of at least two melanocortin peptides in a sample obtained from said subject, the calculation of the ratio of the measured melanocortin peptides and comparison of the value of the ratio with a reference value.

9. Method for predicting risk of obesity in a subject comprising the measurement of at least two melanocortin peptides in a sample obtained from said subject, the calculation of the ratio of the measured melanocortin peptides and comparison of the value of the ratio with a reference value.

10. Method for diagnosing obesity in a subject comprising the measurement of at least two melanocortin peptides in a sample obtained from said subject, the calculation of the ratio of the measured melanocortin peptides and comparison of the value of the ratio with a reference value.

11. Method for diagnosing imbalance in energy homeostasis in a subject comprising the measurement of at least two melanocortin peptides in a sample obtained from said subject, the calculation of the ratio of the measured melanocortin peptides and comparison of the value of the ratio with a reference value.

12. Method for screening medicaments for the adverse reactions of imbalance in energy homeostasis, feeding/weight gain patterns or obesity in a subject to whom the medicament has been administered comprising the measurement of at least 2 melanocortin peptides in a sample obtained from said subject, the calculation of the ratio of the measured melanocortin peptides, and comparison of the value of the ratio with a reference value.

13. Method for screening foods and/or diets for the adverse reactions of imbalance in energy homeostasis, feeding/weight gain patterns or obesity in a subject to whom the medicament has been administered comprising the measurement of at least 2 melanocortin peptides in a sample obtained from said subject, the calculation of the ratio of the measured melanocortin peptides, and comparison of the value of the ratio with a reference value.

14. A method according to any one of claims 8 to 13, wherein the melanocortin peptide ratio calculated is the ratio of desacetyl-α-MSH to α-MSH.

15. A method according to any one of claims 1 to 14, wherein the melanocortin peptides are measured by a biological response system and wherein the resulting profile of response parameters is predictive of the risk

of developing obesity or diagnostic of obesity, imbalance in energy homeostasis or disturbance in feeding/weight gain patterns.

16. Method of assessing risk of developing obesity, diagnosing obesity or diagnosing an imbalance in energy homeostasis or disturbance in feeding/weight gain patterns in a subject, comprising:

a. measuring the amount of α-MSH and desacetyl-α -MSH in a sample obtained from the subject, either directly or by subtraction of one of the amount of α-MSH or desacetyl-α-MSH from a measured amount of total MSH in the sample,

b. calculating the ratio of the amounts of desacetyl-α-MSH to α-MSH,

c. comparing the ratio of desacetyl-α-MSH to α-MSH with a reference ratio.

17. A method according to any one of claims 1 to 16, wherein the measurement is quantitative.

18. A method according to any one of claims 1 to 17, wherein α-MSH and desacetyl-α-MSH are separated from the sample before measurement.

19. A method according to claim 18, wherein α-MSH and desacetyl-α-MSH are separated by a procedure selected from the group consisting of chromatography, electrophoresis, immunocapture and affinity capture.

20. A method according to any one of claims 1 to 14 or 16 to 19, wherein the melanocortin peptide is measured by an immuno-assay.

21. Method of monitoring treatment for obesity or for imbalance in energy homeostasis and/or disturbance in feeding/weight gain pattern in a subject comprising contacting a sample obtained from the subject having such treatment with a biological response system wherein the resulting profile of response parameters is indicative of the effect of such treatment on obesity or imbalance in energy homeostasis and/or disturbance in feeding/weight gain pattern.

22. Method of assessing the risk of developing obesity or developing and/or having an imbalance in energy homeostasis and/or disturbance in

feeding/weight gain pattern in a subject comprising analysing the profile of response parameters in a sample from a test subject by comparing it with

(i) the profile of a sample from a normal subject and

(ii) the profile of a sample from an obese subject or a subject with an imbalance in energy homeostasis and/or disturbance in feeding/weight gain pattern,

wherein resemblance of the profile of the sample obtained from the test subject to that of the profile in (ii) above, is indicative of that subject being at risk of developing obesity or developing and/or having an imbalance in energy homeostasis and/or disturbance in feeding/weight gain pattern.

23. A method according to any one of claims 1 to 22, wherein the subject is a mammal.

24. Method of determining the melanocortin peptide status of a sample comprising contacting the sample with a biological response system wherein the resulting profile of response parameters produced by the biological response system indicates the melanocortin peptide status of the sample.

25. A method according to any one of claims 1 to 24, wherein the sample is a biological fluid selected from the group consisting of whole blood, plasma, serum, saliva, sweat, urine, amniotic fluid, cord blood and cerebrospinal fluid.

26. Method of screening for a compound which acts as agonist or antagonist of a melanocortin receptor comprising treating a biological response system with a test compound and measuring the resulting profile of response parameters that are indicative of agonist or antagonist activity to the melanocortin receptor.

27. Method of screening for a compound that is useful in the treatment of obesity comprising exposing a biological response system to a test compound and measuring the resulting profile of response parameters that are indicative of the desired response for the treatment of obesity.

28. Method of screening for a compound that is useful in the treatment of an imbalance in energy homeostasis or a disturbance in feeding/weight gain patterns comprising exposing a biological response system to a test compound and measuring the resulting profile of response parameters that are indicative of the desired response for the treatment of an imbalance in energy homeostasis or a disturbance in feeding/weight gain patterns.

29. A method according to any one of claims 15 or 21 to 28, wherein the biological response system is an *in vitro* cell, organ or tissue sample, or whole animal capable of responding to melanocortin peptides.

30. A method according to claim 29, wherein the *in vitro* cell is selected from the group consisting of primary osteoblasts, osteosarcoma cell line, hypothalamic cell line, adipocytes, myocytes, melanoma cells and anterior pituitary cells.

31. A method according to claim 29, wherein the organ or tissue sample is that of hypothalamus.

32. A method according to any one of claims 15 or 21 to 31, wherein the profile of response parameters measured comprise one or more proteins or cellular events which differentiate between normal subjects and those at risk of developing obesity or having obesity, or those with an imbalance in energy homeostasis, or disturbance in feeding/weight gain patterns.

33. A method according to claim 32, wherein the one or more proteins are selected from the group consisting of heat shock protein homologue, glyceraldehyde-3-phosphate-dehydrogenase, aldo-keto reductase, citrate synthase, creatine kinase, pyruvate synthase alpha-chain, f1 ATPase beta-chain, tubulin beta-chain, proteins involved in the melanocortin peptidergic axis, proteins involved in signalling pathways and membrane-bound proteins.